

**Design technology**  
**Higher level**  
**Paper 3**

Friday 12 May 2017 (morning)

Candidate session number

1 hour 30 minutes

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**Instructions to candidates**

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions.
- Answers must be written within the answer boxes provided..
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[40 marks]**.



### Section A

Answer **all** questions.

1. **Figure 1** shows the Cimzia home self-injection kit that was designed following the principles of user-centred design.

**Figure 1: Cimzia home self-injection kit**

Please go to: <https://s-media-cache-ak0.pinimg.com/236x/4c/04/6c/4c046cdbfe404ab72b45c7fcc7aaca21.jpg>

It was the first of its kind and was designed with people living with limited mobility of the finger joints in response to their individual needs and challenges. The kit was recognised by the Arthritis Foundation for its ease of use.

- (a) Outline why user-centred design has been applied to the development of the Cimzia system.

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**(Question 1 continued)**

- (b) Outline why the designers of the Cimzia system might have applied the use of personae in user research to assist in its development. [2]

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- (c) List **two** ways how the Cimzia system produces psycho-pleasure for the user. [2]

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- (d) Explain how learnability **and** attitude contribute to the usability of the Cimzia system. [4]

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- 2. Nike has recently introduced lean manufacturing within their supply chain, leading to improved lead times and a reduction in defects such as in the training shoe in **Figure 2**.

**Figure 2: Nike training shoe**



Nike reported that the company worked on the elimination of lost time and lost material from its processes as part of a sustainability agenda. In the factories where the lean approach was implemented, defect rates were reduced by 50 % and lead times were 40 % quicker.

Nike’s approach to lean manufacturing includes worker empowerment – giving factory workers the skills and abilities needed to manage production and immediately address issues as they arise, such as quality or process improvements. These changes put decisions closer to the worker, and require a high level of support to ensure they have the skills and confidence to consistently produce quality products.

- (a) Identify **two** reasons why lean production is more likely to be implemented by large companies rather than small companies.

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**(Question 2 continued)**

(b) Outline how Nike's approach is an example of kaizen. [2]

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(c) Outline which principle of lean production would have the most impact on reducing the delivery times of the products from factory to customers. [2]

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will not be marked.



**(Question 2 continued)**

- (d) Suggest how Nike can use quality assurance (QA) and quality control (QC) to reduce the number of defects in their products.

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12EP07

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## Section B

3. Read the case study. Answer the following question.

The Mode:Flex is an electric powered bike (e-bike) developed by an employee after a call for innovation by the Ford Motor Company. See **Figure 3**.

**Figure 3: The Mode:Flex electric powered bike (e-bike)**



[Source: Ford Motor Company]

The Mode:Flex e-bike has a lightweight frame constructed from carbon fibre and aluminium, which can be folded for easy transport and storage.

The drive system comes from a front hub mounted motor with a lithium-ion battery concealed in the frame giving a range of up to 52 miles (84 Km) on a full charge. It has a highly efficient transfer of energy from the pedals to the hub, compared to the traditional bicycle chain design. It requires very little maintenance.

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**(Question 3 continued)**

The cyclist can select “Sporty”, “Economy”, and “Comfort” modes from the handlebar display unit shown in **Figure 4**.

**Figure 4: A handlebar display unit.**



[Source: Ford Motor Company]

Sensors monitor the patterns of the cyclist’s pedalling and transmit this information to a control unit. The control unit determines whether the electric motor is used and synchronises the power of the electric motor with the power of the rider’s leg muscles. This information can also be transmitted through the Mode Link app\* to the user providing him/her with fitness data. The app also communicates the location of the cyclist and communicates with city wide information systems to provide bus or train times, the location of the nearest car park (parking lot) and weather information.

The Mode:Flex e-bike has been developed using the principles of sustainable innovation rather than sustainable design.

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\* app: application software, typically small, specialized programs downloaded onto mobile devices; apps can also run on the internet, on a computer, or on a cell/mobile phone or other electronic device.

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12EP09

**Turn over**

**(Question 3 continued)**

- (a) List **two** potential consumer target groups which may be early adopters for the Ford Mode:Flex e-bike. [2]

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- (b) List **two** ways in which the concept of a product family can be applied to the Ford Mode:Flex e-bike. [2]

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- (c) Describe how Ford might be meeting their corporate social responsibility objectives through the Mode:Flex e-bike. [2]

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**(Question 3 continued)**

- (d) Explain why the Mode:Flex e-bike is an example of sustainable innovation rather than sustainable design.

[5]

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12EP11

**Turn over**

**(Question 3 continued)**

- (e) Explain how triple bottom line (environmental, economic and social) sustainability applies to the Ford Mode:Flex e-bike.

[9]

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